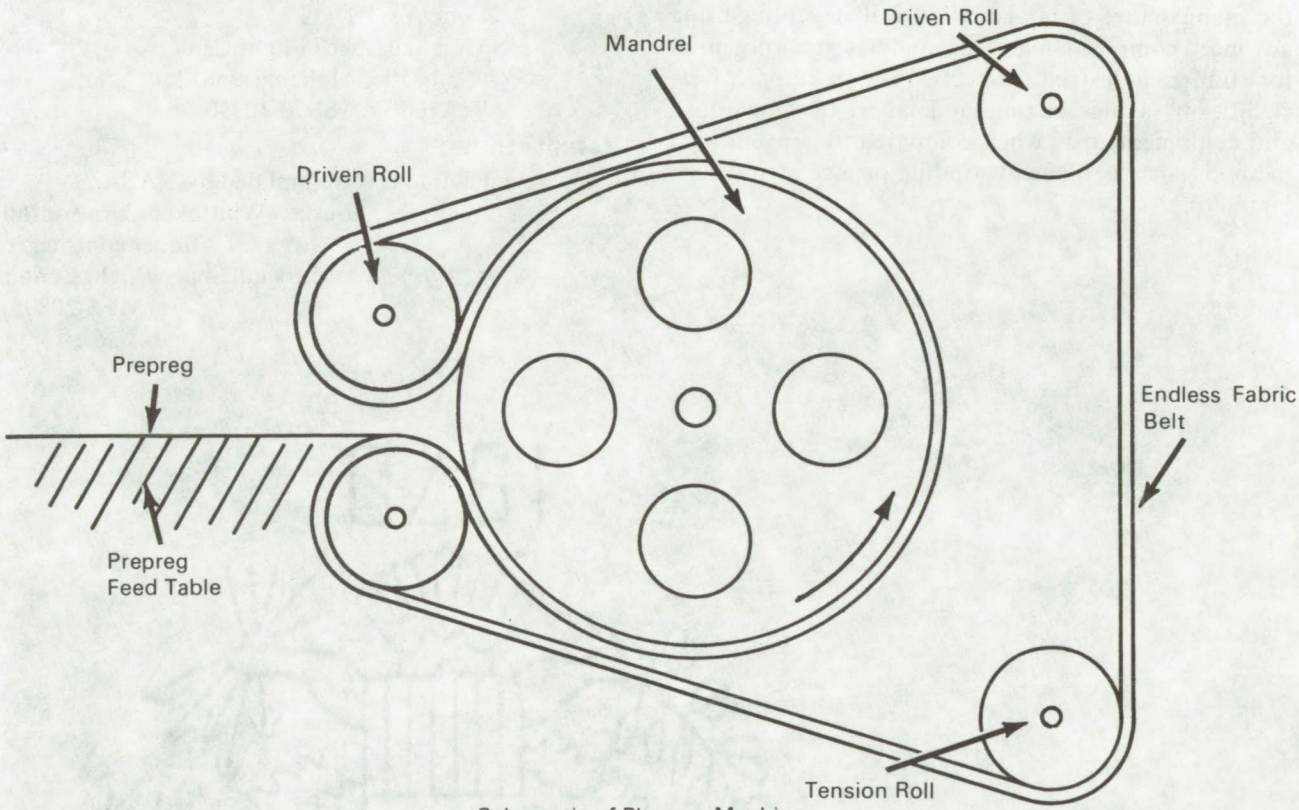
NASA TECH BRIEF

Fabricating Subscale Components for Application to Full-Scale Parts



Schematic of Plywrap Machine

The development of new high-efficiency composite structural materials has stimulated research on the technology required for manufacturing large-scale components. Manual lay-up manufacturing techniques, particularly those using filament and tape as reinforcement materials, have become increasingly more expensive with the advent of mechanized processing.

The objective of this study was to determine the equipment requirements and to investigate fabrication methods for a large cylindrical shroud. The study was conducted in phases as follows: a boron/epoxy, honeycomb sandwich, subscale cylinder was fabricated; the design and weight of the full-scale boron/epoxy structure were analyzed and compared with those of other structures using alternate materials; the cost of fabricating a full-scale boron/epoxy structure was compared to the cost of fabricating structures of alternate materials; and a manufacturing plan

(continued overleaf)

for fabrication of the full-scale cylindrical shroud, using boron/epoxy, was prepared.

The sandwich design using boron/epoxy material indicated a significant potential weight saving over structures made of conventional materials. The fabrication technique successfully demonstrated on the subscale component offered good potential for application to large components.

Earlier research indicated a potential for a mechanized lay-up device, as shown in the figure, which featured application of broadgoods to a mold via a continuous belt. The technique, designated plywrap, proved well suited to the fabrication of cylindrical shapes and other shapes created by wrapping a plane surface.

The plywrap concept should be easily adaptable to the manufacture of larger cylindrical structures using advanced composite materials, and has great potential for future industrial projects. The method offers significant savings in time and labor, raw materials, and equipment costs when compared to conventional methods such as filament winding or mechanical tape laminating.

Notes:

1. It is recommended that a "scale-up" study be initiated in which cylindrical shrouds utilizing both graphite and boron reinforcements would be fabricated to approximately 1:4 scale. The purpose of the study would be to resolve fabrication details and to yield two scale model units which could be structurally tested for verification of the design. The analysis and design of edge attachment and closeout methods should also be examined in an attempt to achieve high weight efficiency through the use of advanced composite materials in the attachment members.
2. Requests for further information may be directed to:

   Technology Utilization Officer
   Code A&TS-TU
   Marshall Space Flight Center
   Huntsville, Alabama 35812
   Reference: TSP70-10390

Patent status:

No patent action is contemplated by NASA.

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